2017-1341, -1403

In The
United States Court of Appeals
For The Federal Circuit

SIRONA DENTAL SYSTEMS GMBH,

Appellant,

v.

INSTITUT STRAUMANN AG, DENTAL WINGS INC.,

Cross-Appellants.

APPEAL FROM THE UNITED STATES PATENT AND TRADEMARK OFFICE, PATENT TRIAL AND APPEAL BOARD CASE IPR2015-01190.

BRIEF OF CROSS-APPELLANTS

David M. Airan
Thomas P. Canty
Aaron R. Feigelson
Wesley O. Mueller
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza, Suite 4900
Chicago, Illinois 60601
(312) 616-5600 (Telephone)
(312) 616-5700 (Facsimile)
dairan@leydig.com
tcanty@leydig.com
afeigelson@leydig.com
wmueller@leydig.com

Counsel for Cross-Appellants

THE LEX GROUP^{DC} ♦ 1825 K Street, N.W. ♦ Suite 103 ♦ Washington, D.C. 20006
(202) 955-0001 ♦ (800) 856-4419 ♦ Fax: (202) 955-0022 ♦ www.thelexgroup.com

CERTIFICATE OF INTEREST

Counsel for Appellees / Cross-Appellants Institut Straumann AG and Dental Wings, Inc. certify the following:

1. The full name of every party or amicus represented by us is:

   Institut Straumann AG and Dental Wings, Inc.

2. The name of the real party in interest (if the party named in the caption is not the real party in interest) represented by us is: N/A

3. All parent corporations and any publicly held companies that own 10% or more of the stock of any party represented by us are:

   Straumann Holding AG, which is a parent corporation of Institut Straumann AG and Dental Wings, Inc. and is the only publicly held company that owns 10% or more of Institut Straumann AG's and Dental Wings, Inc.'s stock.

4. The names of all law firms and the partners or associates that appeared for the parties now represented by us in the trial court or are expected to appear in this court are:

   Leydig, Voit & Mayer, Ltd.: David M. Airan, Thomas P. Canty, Aaron R. Feigelson, and Wesley O. Mueller.

   O'Kelly, Ernst & Bielli: Daniel P. Murray and Sean T. O'Kelly have appeared on behalf of the parties in related litigation.

Dated: May 1, 2017

/s/Wesley O. Mueller

Wesley O. Mueller
LEYDIG, VOIT & MAYER LTD.
Two Prudential Plaza, Suite 4900
Chicago, Illinois 60601
Telephone: (312) 616-5600
Facsimile: (312) 616-5700
wmueller@leydig.com

Principal Counsel for Cross-Appellants
Institut Straumann AG and Dental Wings, Inc.

TABLE OF CONTENTS

TABLE OF AUTHORITIES

Cases

Statutes

Rules

STATEMENT OF RELATED CASES

This appeal and cross-appeal arise from *inter partes* review ("IPR") Case IPR2015-01190 in which the Patent Trial and Appeal Board (the "Board") issued a final written decision determining claims 1-8 of U.S. Patent No. 6,319,006 (the "'006 patent") to be unpatentable, finding claims 9-10 of the '006 patent to be patentable, and denying Patent Owner Sirona Dental Systems GmbH's ("Sirona") Contingent Motion to Amend. Institut Straumann AG and Dental Wings Inc. (collectively, "Straumann") were the Petitioners in the IPR. No "appeal in or from the same [IPR] was previously before this or any other appellate court." Fed. Cir. R. 47.5.

Three pending district court cases relating to the '006 patent, which are presently stayed, will be impacted by the result of these appeals: *Sirona Dental Systems GmbH v. 3Shape Medical A/S*, Civil Action No. 1-15-cv-00278 (D. Del.), *Sirona Dental Systems GmbH v. Anatomage, Inc.*, Civil Action No. 1-14-cv-00540 (D. Del.), and *Sirona Dental Systems GmbH v. Dental Wings Inc.*, Civil Action No. 1-14-cv-00460 (D. Del.).

INTRODUCTION

The '006 patent claims planning steps for a dentist to produce a surgical drill template (or "drill guide") by correlating an X-ray with three-dimensional optical measurements of the patient's jaw and teeth. The Board determined this subject

matter to be unpatentable in view of prior art the USPTO did not consider during the original prosecution.

The Bannuscher prior art reference, published prior to the critical date, disclosed planning steps for a dentist to produce a surgical drill template by correlating an X-ray image of the mouth and jaw area with a three-dimensional geometric model in a computer simulation. The Truppe prior art reference, also published prior to the critical date, disclosed ***optical*** measuring in three-dimensions and correlating measurements with X-ray data. A person of ordinary skill in the art would have been motivated to apply Truppe's optical imaging to Bannuscher's surgical drill template planning, and the Board's finding in this regard is supported by substantial evidence. That was all that was needed to hold claims 1-8 of the '006 patent obvious.

In this appeal, Sirona targets an alleged error in the original translation of the Bannuscher reference, and incorrectly argues that the Board adopted a theory of unpatentability that the parties had not previously argued. The Board's application of Bannuscher was not a new theory; Straumann presented evidence and argument in its original Petition regarding Bannuscher, and again in its subsequent Reply Brief. Sirona countered with its own submissions, all of which the Board considered in its Final Written Decision. The alleged mistranslation of Bannuscher was not material to the factual determinations made by the Board because both

translations support the Board's conclusion; the Court should reject Sirona's unfounded criticism of Straumann and the Board regarding this reference.

The claimed step Sirona argues that Bannuscher does not disclose – *i.e.*, three-dimensional measuring of the visible surfaces of the jaw and teeth – is in fact disclosed. In the Bannuscher system, three-dimensional models of the patient's jaw and teeth as well as X-ray images are "input into a computer." Appx665, 8:36-39. The "central idea" of Bannuscher's invention is "to bring together the X-ray diagnostics and the model situation or oral situation of the patient" for the purpose of producing a drill template. *Id.*, 8:20-35. The Board's factual conclusions regarding Bannuscher were based on its own review of this prior art reference as well as the complete record relating to it, including testimony from Straumann's expert, Dr. Louis Benjamin. Substantial evidence supports the Board's conclusion regarding the alleged missing element.

The Board also correctly determined that "substitute" claims 11-18 are not patentable. These proposed claims included the limitations of issued claim 1 and added a further limitation requiring a machine to actually produce a drill guide with negatives of neighboring teeth based on the "three-dimensional optical data" acquired during the planning steps. The Board correctly determined that use of a machine, such as computer numerical control or "CNC" milling, was a known

technique for producing a drill template from a three-dimensional computer model. Appx55. There was nothing patentable in the proposed claims.

The Board, however, should have applied its factual findings regarding proposed claims 11-18 to issued claims 9-10 of the '006 patent. The subject matter of these issued claims overlaps the proposed substitute claims, and the factual determinations regarding the substitute claims apply with equal force to claims 9-10. As a matter of law, claims 9-10 are also unpatentable based on the same prior art findings the Board made in connection with Sirona's proposed claim amendments.

The Board's decision that claims 1-8 are unpatentable should be affirmed. The Board's decision that Sirona's substitute claims 11-18 are unpatentable should also be affirmed. In light of the facts determined by the Board in consideration of Sirona's substitute claims, the Board's decision that claims 9-10 are not obvious should be reversed or at least vacated and remanded.

JURISDICTIONAL STATEMENT

The Board had jurisdiction over this IPR under 35 U.S.C. § 6. The Board's Final Written Decision issued on November 15, 2016. Appx1. Sirona filed its notice of appeal on December 9, 2016. Appx546-550. Straumann filed its notice of cross-appeal on December 22, 2016. Appx551-555. Straumann's cross-appeal is timely under Federal Rule of Appellate Procedure 4(a)(3) and 37 C.F.R.

§ 90.3(a)(1). This Court has jurisdiction over Straumann's cross-appeal under 35 U.S.C. §§ 141(c) and 319 and 28 U.S.C. § 1295(a)(4)(A).

STATEMENT OF THE ISSUES

1. Whether the Board correctly ruled that claims 1-8 of the '006 patent are obvious.

2. Whether the Board correctly denied Sirona's Motion to Amend because Sirona had not established the patentability of proposed substitute claims 11-18.

3. (Cross-Appeal) Whether the Board erred by not applying its factual findings regarding Sirona's Motion to Amend to dependent claims 9-10.

STATEMENT OF THE CASE

I. THE PRIOR ART

The technology at issue relates to the manner in which a practitioner plans the location and orientation of a dental implant relative to the patient's jaw. Prior art approaches to this problem included computerized planning of a drill template based on X-ray and three-dimensional data. The template then fits onto a patient's teeth to assist the dentist in drilling a bore hole for the implant.

The prior art includes numerous examples of planning software to assist in creating and producing drill templates. Appx565-566, ¶¶ 23, 26. Most relevant to this appeal are German Patent Pub. No. DE 19510294 A1 to Bannuscher

("Bannuscher"), U.S. Patent No. 5,842,858 to Truppe ("Truppe"), U.S. Patent No. 5,725,376 to Poirier ("Poirier"), U.S. Patent No. 5,967,777 to Klein et al. ("Klein"), and a publication authored by Willer et al., entitled "Computer-assisted milling of dental restorations using a new CAD/CAM data acquisition system," *The Journal of Prosthetic Dentistry*, Vol. 80, No. 3 (1998) ("Willer"). Appx661; Appx653; Appx1633; Appx671; Appx2236.[1]

A. Bannuscher

Bannuscher, published on October 2, 1996, discloses a computerized planning method to produce a drill template for dental implants in the jaw. Appx661, Abstract. Bannuscher allows the practitioner to obtain a "general medical and implant-specific assessment of the patient's situation," that is, of the patient's jaw and teeth. Appx662, 2:22-24; *see* Appx1551-1552, 2:32-3:1; Appx597-598, ¶ 84. Bannuscher creates a "three-dimensional computer simulation" to permit the practitioner to plan the surgery. Appx665, 7:1-8.

To plan the drill template, the practitioner takes a dental impression and creates plaster models of the upper and lower jaw to provide a visual topography of the patient's jaw and teeth. *Id.*, 8:23-29. The plaster models are placed onto a

[1] Bannuscher is a German language publication. Except as indicated, all citations herein are to the certified English language translation proffered by Straumann. Appx661-670.

"skull-based simulator." *Id.*, 8:36-39. The practitioner also takes an X-ray of the patient's jaw. *Id.,* 8:29-35; Appx597-598, ¶ 84.

The "three-dimensional plaster models and the X-ray image relating to the patient's skull are then input into a computer." Appx665, 8:36-39. Bannuscher discloses a visual representation of the actual physical proportions of the patient's jaw and teeth because the digitized three-dimensional model represents the jaw and teeth of the patient. Appx598, ¶ 85; Appx665, 8:29-35. Therefore, all of the data required to assess the oral situation of the patient are brought together. Appx665, 8:36-39; *see also* Appx664, 6:24-28 ("To functionally configure the implantological-prosthetic planning, the entire occlusion structure can be recorded and as far as possible all necessary parameters can be combined together."); Appx598, ¶ 85.

The supporting zone regions of the implants are marked by static measuring points and data are transferred into the X-ray image in a correlation step. Appx665-666, 8:43-9:10. A rendering of the correlated data enables a dentist to determine an optimum position of the implant and the available vertical bone supply. Appx598-599, ¶ 86. The dentist obtains "[t]he information about the path of nerve channels and anatomical data of the bone" in a "transparent and quantitative manner." Appx666, 9:12-16. These data identify implant supporting

zones and the "angles [of drilling], which are of primary importance for an implantation procedure." *Id.*, 9:25-30.

B. Truppe

Truppe, patented on December 1, 1998, discloses a method that uses computer simulation to enable "careful planning" of a dental implant by correlating digital data from X-rays and optical imaging regarding the patient's oral situation. Appx656, 2:8-11. X-ray data and optical image data are merged together in a computer simulation to show a superposition of the data sets in a "positionally correct" orientation. Appx657, 3:19-20. Truppe correlates "at least one picture of the jaw of the person with an imaging process, such as X-ray . . . including the marking points in the picture, and storing the picture in memory as a data set." Appx656, 2:41-45.

As illustrated in FIG. 1 (Appx654; reproduced below), a plastic positioning device 3 with embedded lead beads 4 is located in the oral cavity 2, and a 3-D sensor 5 is connected to the device 3. Appx658, 5:54-62. 3-D sensors are also located in fixed positions on the jaw to obtain relative position information in three dimensions. Appx656, 2:65-3:11; Appx658, 5:63-67.

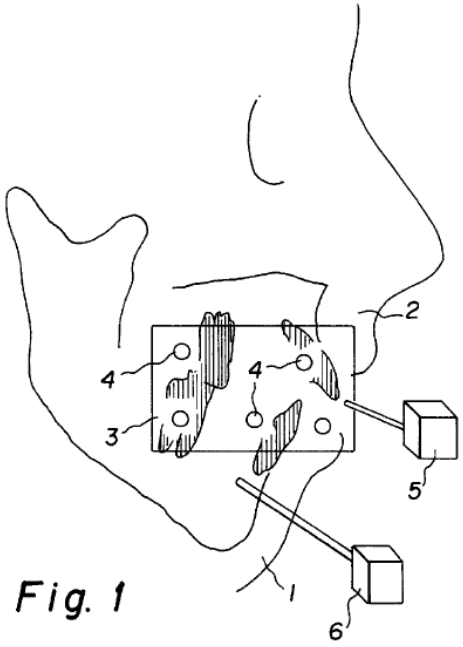
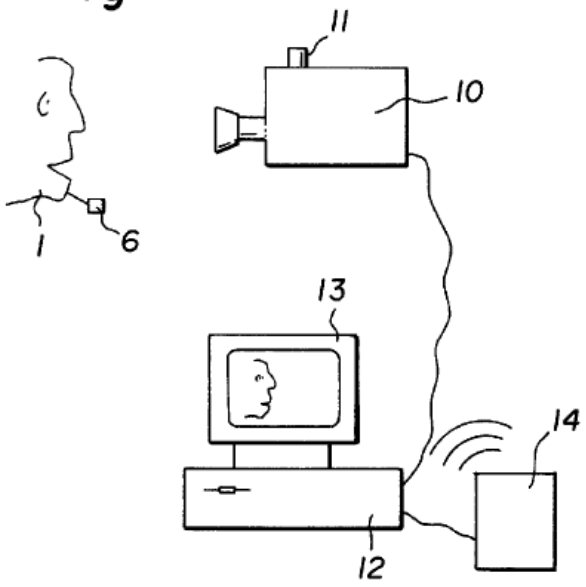


Fig. 1

Fig. 2



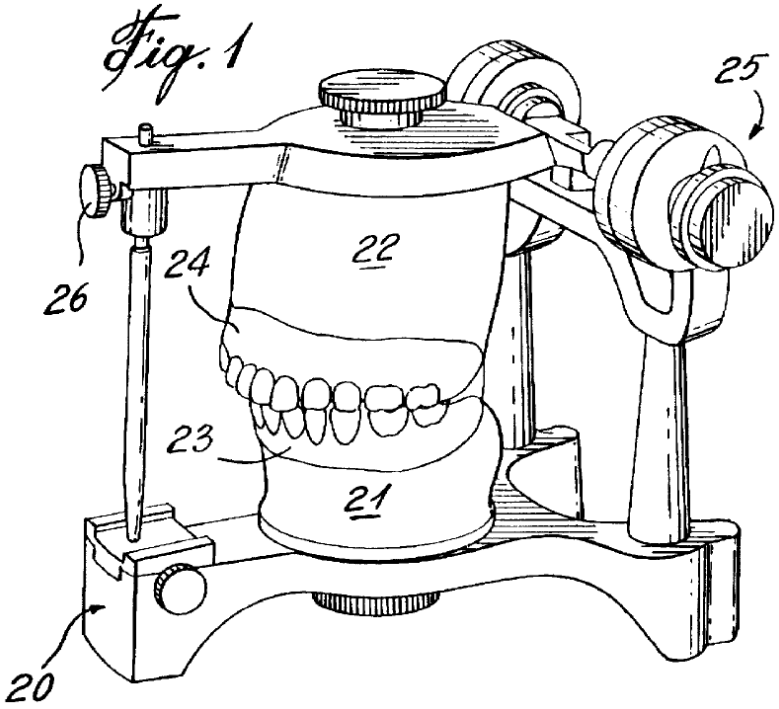
A camera 10, also having a 3-D sensor 11, captures an optical image or sequence of images, as shown in FIG. 2 (Appx654). A computer processes the optical images to provide positionally correct information that may be displayed. Appx658, 6:4-6.

Truppe discloses benefits to optically imaging a stereolithographic model of the oral cavity and the oral cavity itself. Appx657, 3:48-55. According to Truppe, both the oral cavity and model representations are desirable in the planning process. *See* Appx591, ¶ 69; *see also* Appx657, 3:47-50 ("In a second aspect of the present invention, the representation is not done with the applicable jaw itself; instead, a stereolithographic model of the jaw is made in a known manner."). The representations are compared to represent "very vividly" the relationship between the actual jaw and the model. Appx657, 3:56-58.

The data set from the optical image of the jaw or the model is superimposed with a data set captured from an X-ray source. This is done by processing the optical image information and the X-ray data. *Id.*, 3:19-27 ("By carrying out a number of coordinate transformations, it is possible to position the data set such that the structures of the data set always still match . . . the corresponding structures of the optical image."). The optical data set obtained relative to the stereolithographic model of the jaw is also superimposed with the X-ray data set to represent the model in a "positionally correctly superimposed data set" to enable operation planning and simulation. Appx592, ¶ 70; *see also* Appx657, 3:52-53. Truppe therefore discloses carrying out the optical measuring of the jaw and teeth in three dimensions and superimposing the resulting data set with the X-ray data set to provide a "positionally correctly superimposed data set." Appx657, 3:52-53.

C. Poirier

Poirier, patented on March 10, 1998, discloses the acquisition of surface data and X-ray data in planning a dental implant procedure. Unlike Bannuscher, which discloses a drill template for a partially edentulous case, Poirier discloses a drill template for a fully edentulous case. Poirier first provides a physical model of the patient's jaw in an articulator 20, as shown in FIG. 1 (Appx1634; reproduced below). This model is used to create a computerized representation of the patient's jaw and teeth. Appx1644, 3:12-17.



A "3-D computer model 29" is created using radiographic 3-D imaging data and "referenced gum surface image data," which is acquired by laser camera imaging techniques. Appx1645, 6:19-22; Appx1644, 3:56-60; Appx1636, FIG. 5; Appx761, ¶ 11. Figure 5 (Appx1636; reproduced below) shows a process for using radiographic 3-D imaging data (denoted in blue) and surface image data (38 and 39, shown in red) to create a drill template. *See* Appx1643, 2:9-12; Appx1646, 8:46-49.

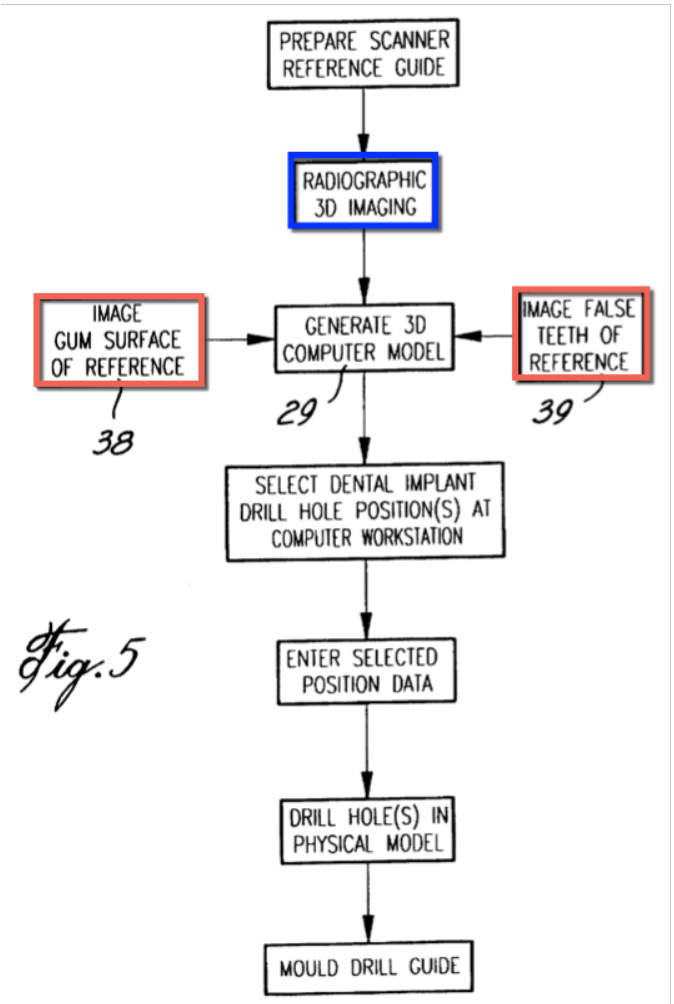


Fig. 5

Poirier's preferred process molds the drill template, but this is a matter of design choice. The reference also discloses using a CNC device to form the entire drill template body. Appx1644, 3:47-49; Appx761-762, ¶ 12.

D. Klein

Klein, patented on October 19, 1999, discloses a drill template made from a plastic replica of a patient's teeth and jaw near an implant position. Figure 2 (Appx672; reproduced below) shows the patient's teeth 22, 24 relative to the implant position. In FIG. 3 (Appx672; also reproduced below), Klein shows

plastic teeth 32, 34 together with anchors 36, 38 that attach the plastic replica to the neighboring teeth. Appx683, 7:32-37.

FIG. 2

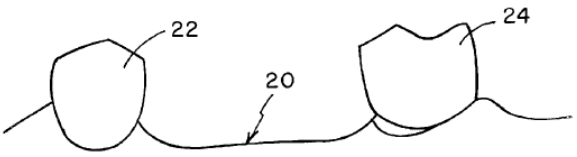
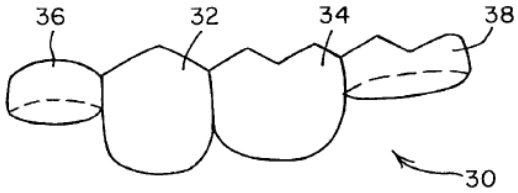
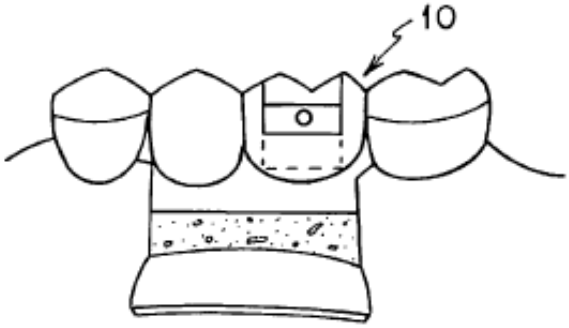


FIG. 3



In FIG. 23 (Appx677; reproduced below), the drill template has been manufactured and attached to the patient's teeth with the anchors 36, 38 positioned over the surfaces of the patient's teeth. The anchors match the teeth 22, 24 including negatives of occlusal surfaces of neighboring teeth.

FIG. 23



As is customary, the method of this prior art discloses scanning a patient's jawbone and teeth, and using software to superimpose 3-D simulated dental implants in a 3-D scan image. Appx566-567, ¶ 27; Appx683, 8:38-49; Appx763-764, ¶ 17. The practitioner optimizes the position and trajectory of the dental implant with surgical simulation software interfaced with a computer-driven

milling machine. Appx763-764, ¶ 17. The simulation software takes the 3-D positioning data of the simulated dental implant to accurately form a guide hole in the drill template. Appx684, 9:6-16; Appx674, FIGS. 11-12; Appx763-764, ¶ 17.

E. Willer

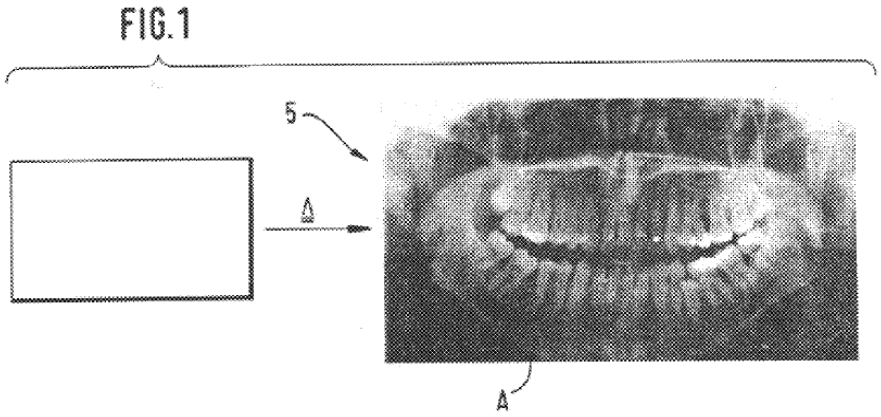
Willer, published in 1998, discloses a CAD/CAM milling technology "especially developed for dental applications." Appx2240; Appx762, ¶ 14. Willer generates three-dimensional digitized surface data for dental structures to construct a computer simulation. Appx2237; Appx762, ¶ 14. Based on the three-dimensional surface data, the dental structure is precision milled from a "block of base material." Appx2236; Appx1447-1448, ¶ 58; *see also* Appx762, ¶ 15.

II. THE '006 PATENT

At the time Sirona filed its patent application, dental surgical template planning had been performed by correlating surface data of the jaw and teeth and X-ray image data. Sirona's patent, however, incorrectly suggested that prior art drill templates for tooth implants required the dentist to rely on individual experience to perform the implant procedure. Appx61, 1:39-46.

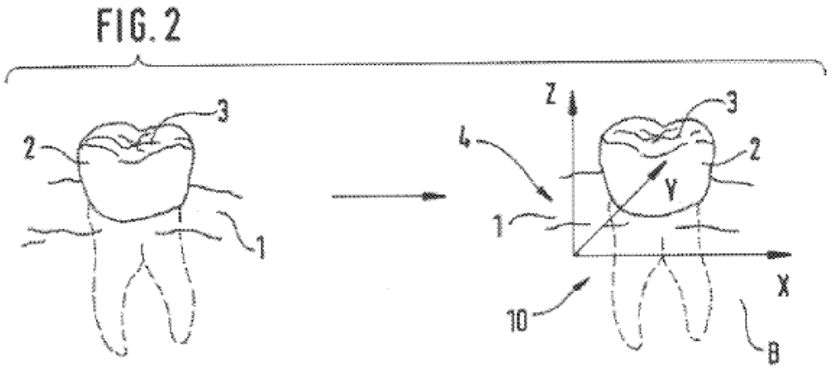
To overcome a self-described problem, the specification thereafter describes a method for producing a drill assistance device that allowed the drilling of "a pilot hole for a tooth implant" relative to other teeth in the jaw. Appx61, 2:8-10. To

plan the drill assistance device, "measured data records" produced from the X-ray picture are compiled. Appx61, 2:15-16.



Appx59. Based on the X-ray, the "optimal pilot hole position" for the dental implant, including its orientation, is planned by observing the location of the nerve tracts in the jawbone. Appx60, FIG. 5; Appx62, 4:17-23, 4:63-67.

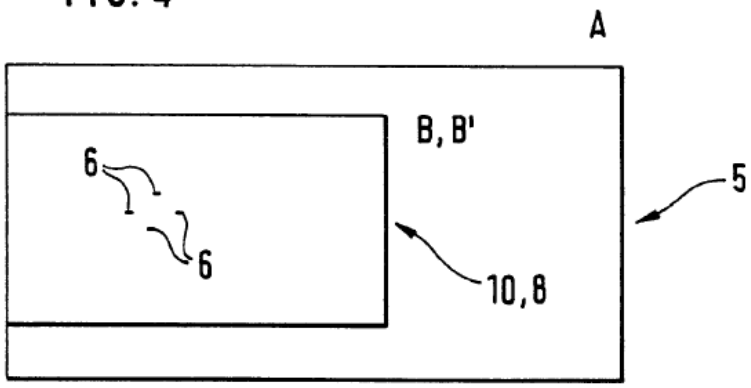
The method also generates three-dimensional optical measurement data of the visible surfaces of the jaw and teeth. Appx61, 2:17-20. While it refers to a "three-dimensional optical image," the specification does not explain what instrument acquires the measurement data. Appx62, 3:54-56. The patent shows a single tooth, as shown in FIG. 2 (Appx59; reproduced below).



Measurement data records of the X-ray picture are correlated with three-dimensional optical measuring data, but the specification does not provide any algorithms or other implementation detail for doing so. Instead, an X-ray is superimposed on a three-dimensional image by using "markers 6" attached to the teeth. Appx62, 3:63-67, 4:1-2; Appx60, FIG. 4.

The specification also describes a pseudo-X-ray B' generated from surface data of the three-dimensional image. Appx62, 4:3-8; Appx60, FIG. 4. A user overlaps the X-ray 5 (of all of the teeth) and the pseudo-X-ray B' (of a single tooth), as shown in FIG. 4 (Appx60; reproduced below). Appx62, 4:8-9.

FIG. 4



After the data records are correlated, the practitioner plans the position of the implant relative to occlusal surfaces of neighboring teeth, including the implant bore hole location and depth. Appx62, 4:31-36. A drill template is created, as shown in FIG. 5 (Appx60; reproduced below).

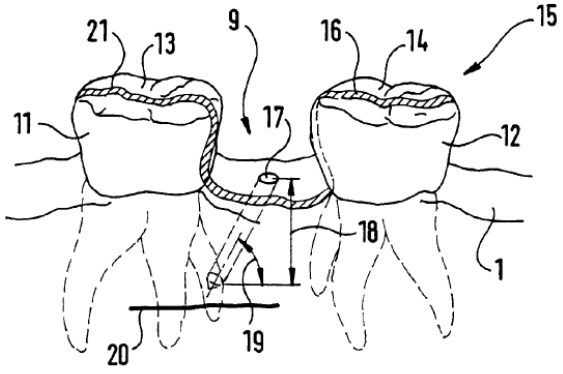


FIG. 5

The ’006 patent discloses a CAD/CAM machine to grind the drill template, including the negatives of adjacent tooth surfaces. Appx62, 4:38-41. When seated in the patient’s mouth, the drill assistance device provides the desired position and angle of the implant pilot hole as a guide for the dentist. Appx62, 4:51-67.

Claim 1 recites:

> Method for producing a drill assistance device for a tooth implant in a person’s jaw, comprising the following process steps:
>
> taking an x-ray picture of the jaw and compiling a corresponding measured data record,
>
> carrying out a three-dimensional optical measuring of the visible surfaces of the jaw and of the teeth and compiling a corresponding measured data record,
>
> correlating the measured data records from the x-ray picture and from the measured data records of the three-dimensional optical measuring,
>
> determinating the optimal bore hole for the implant, based on the x-ray picture, and
>
> determinating a pilot hole in a drill template relative to surfaces of the neighboring teeth based on the x-ray picture and optical measurement.

Appx63, 5:2-18. Sirona does not dispute that claims 2-8, which depend from claim 1, rise or fall with claim 1 in the present appeal of the Board's decision. Appx42.

> Claim 9 depends from claim 1 and includes the additional limitation:
>
> wherein the drill assistance device is ground out from a dimension-stable material, and said material represents the form of occlusal surfaces of neighboring teeth as a negative with respect to an implant position.

Appx63, 6:17-21. Sirona did not argue that claim 10 was separately patentable from claim 9.

III. PROCEEDINGS BEFORE THE BOARD

Straumann petitioned for IPR of claims 1-10 of the '006 patent on May 11, 2015. Appx137. The petition identified four grounds of invalidity. Ground 4 established that claims 1-10 are rendered obvious by Bannuscher and Truppe. Appx186-199. Straumann supported its petition with testimony from Dr. Benjamin. Dr. Benjamin testified that correlating X-ray data and three-dimensional optical data and planning a drill template through simulation were known at the time of the claimed invention, and that a person of ordinary skill in the art would have been motivated to combine the teachings of Bannuscher and Truppe to yield the planning method recited in claims 1-10 of the '006 patent. Appx599-602, ¶¶ 89-93.

Sirona filed a Preliminary Response on August 26, 2015. Appx201. Sirona asserted that Bannuscher and Truppe were in two different fields, and therefore

Truppe did not provide the motivation for one of skill in the art to extend the Bannuscher template planning to include optical information of the patient's jaw and teeth. *See* Appx237. Sirona further argued that Truppe does not disclose three-dimensional optical measuring because it uses a conventional camera. Sirona did not raise in its Preliminary Response the arguments that it now asserts in this appeal, *i.e.*, that Bannuscher does not disclose a measurement of the visible surface structures of the jaw and teeth or the use of 3-D model geometry data in the computer planning simulation.

The Board issued a Decision on Institution on November 16, 2015, finding a reasonable likelihood that claims 1-10 were obvious in view of the combination of Bannuscher and Truppe. Appx260. The Board separately found a reasonable likelihood that claims 1-4 and 9-10 were also anticipated by U.S. Patent No. 5,562,448 to Mushabac ("Mushabac"; Appx623). Appx252. With regard to Bannuscher, the Board determined that after a plaster model is cast from a patient's mouth or jaw, "the 3-D geometry of the plaster model and an X-ray image of the mouth and jaw are both 'input into a computer by digital transfer.'" Appx258 (quoting Appx662, 2:22-28; Appx665, 8:25-39).

Sirona filed a Patent Owner Response (Appx262) on February 1, 2016, and submitted the supporting Declaration from its expert, Dr. Douglas Erickson (Appx1419). Sirona asserted that the translation of Bannuscher regarding

"Registrierbogen" should be "recording bow," rather than "recording sheet." Appx312. Sirona asserted that Straumann did not explain how Bannuscher disclosed capturing 3-D ***optical*** data because a recording bow measures the angularity of the jaws. Like its Preliminary Response, Sirona's Response did not advance the argument that it now makes in this appeal.

Sirona also filed a Contingent Motion to Amend in which it presented substitute claims 11-18. Appx330. Sirona's substitute claims added the requirement that a machine produce the drill template based on the measured data record obtained from the three-dimensional optical measuring. Appx333.

Straumann filed its Reply Brief on April 29, 2016. Appx386. The brief explained why Sirona's "recording bow" argument did not add anything to the patentability inquiry. Appx408-410. That Bannuscher disclosed a recording sheet/bow for one aspect of its measurements did not somehow undercut Bannuscher's express and separate disclosure that the 3-D geometry of a plaster model and an X-ray image of the mouth and jaw are both required inputs to a computer by digital transfer, and that these data were used to produce a drill template. Appx409. Sirona's argument in the IPR regarding the "recording bow," like its similar argument in this appeal, therefore does not address Bannuscher's relevant teachings. Straumann also explained that Sirona's arguments regarding Truppe were unfounded because Truppe disclosed optical measuring of the jaw

and teeth in three dimensions, in accordance with the Board's broadest reasonable construction of the phrase. Appx408.

The Board issued a Final Written Decision on November 15, 2016. Appx1. The Board found that Bannuscher disclosed the three-dimensional measuring of the visible surfaces of the jaw and teeth because, in Bannuscher, 3-D geometry of the plaster model for the patient's jaw and teeth and an X-ray are digitally input into a computer. Appx32. The Board based its determination, in part, on its finding that Sirona did not challenge Straumann's evidence regarding the digital input to a computer of the three-dimensional geometry of the plaster models for the teeth and jaw. *Id.* The Board also explained that Truppe disclosed carrying out a three-dimensional optical measuring of the jaw and teeth, together with correlating such measurements with X-ray data, as the '006 patent claims require. Appx28-31. The Board found that a skilled artisan would have been motivated to combine Bannuscher and Truppe because of the recognized benefit of utilizing Truppe's superimposed optical imaging and X-ray data sets in Bannuscher's method of planning an implant surgical procedure and producing a drill assistance device. Appx37-41.

SUMMARY OF THE ARGUMENT

Substantial evidence supports the Board's decision that claims 1-8 of the '006 patent are obvious over Bannuscher and Truppe. Bannuscher discloses

planning a drill template through computer simulation by combining an X-ray image of the mouth and jaw area and a three-dimensional geometric model thereof. Bannuscher discloses all but one element of claims 1-8 of the '006 patent. The remaining element – carrying out a three-dimensional optical measuring of the visible surfaces of the jaw and of the teeth – is disclosed by Truppe.

Sirona's argument that Bannuscher discloses digital input of jaw joint movement alone was not raised below, and was thus waived, but it is also incorrect on the merits. Bannuscher discloses that "three-dimensional plaster models and the X-ray image relating to the patient's skull" are digitally input as part of a computer simulation. Sirona fixates on the translation of "Registrierbogen" to mean "recording bow," instead of "recording sheet," in support of its argument that Bannuscher did not disclose measuring jaw and teeth surface data. But Bannuscher is not limited to a recording bow or sheet. Instead, Bannuscher makes clear that the entire occlusion structure, *i.e.*, the surface structure for the jaw and teeth, is measured and recorded and this data is combined with X-ray image data.

Sirona also incorrectly argues that Straumann shifted the burden to Sirona to demonstrate that Bannuscher did not measure surface structure. This argument fails because both Straumann and the Board relied on Bannuscher's relevant disclosure regarding the digital data provided to Bannuscher's computer simulation. From the outset, Straumann relied on Bannuscher's disclosure that

"[t]he three-dimensional plaster models" themselves are digitized and transferred to the computer.

Sirona's arguments that the Board introduced misunderstandings in its Final Written Decision are variants of Sirona's primary argument that Bannsucher discloses jaw joint movement data alone. These arguments all fail because Bannuscher discloses digital input of jaw and tooth surface structures for computer simulation. This digital data is "3-D geometry ***data***," as the Board found. Bannuscher also discloses digital input of the "visual topography" of the jaw and teeth through development of the plaster models, which become a digitized three-dimensional model in the computer simulation. The Board did not present a new theory in its Final Written Decision by reference to Bannuscher's "markers." The Board correctly determined that Bannuscher discloses a comparison between the location of the teeth and the bone supply with markers to correlate the three-dimensional geometry model data and the X-ray data.

Sirona's argument that Truppe does not disclose "carrying out a three-dimensional optical measuring" of the jaw and teeth ignores the Board's construction of the phrase to mean "using light to measure the visible surfaces of the jaw and teeth in three dimensions." The Board did not specify a particular type of recording instrument, nor did it require a 3-D optical image. The Board correctly determined that Truppe's optical measurements are taken with reference

to a three-dimensional coordinate system; otherwise, the dental structures in the optical image cannot be aligned in three-dimensional space relative to the X-ray image data. Truppe uses light to measure the dental structures in three dimensions, such that the dental structures are positioned relative to three-dimensional coordinates. That is all the claim element requires.

Sirona's arguments that a skilled artisan would not have been motivated to combine Truppe with Bannuscher similarly fail. Bannuscher and Truppe are directed to the same implant planning technology that requires planning and modeling of the patient's jaw and teeth. The Board relied on expert testimony that a skilled artisan would have been motivated to combine Bannuscher and Truppe based on the enhancement of "positionally correct" data sets disclosed by Truppe's correlation of three-dimensional optical surface data with X-ray data. A skilled artisan would have recognized the benefit of comparing the actual jaw to a model, as disclosed by Truppe, to assist in Bannuscher's implant planning method. Sirona criticizes the Board for determining Bannuscher's disclosure that "all the necessary [clinical] parameters" for pre-surgical implant planning can be "combined together," without specifying what such parameters might be. Bannuscher, however, discloses that such parameters include digital data regarding "the entire occlusal structure," the "static occlusion," and the "available bone supply" in the jaw. In other words, Bannuscher specifies the motivation to combine with Truppe.

Substantial evidence supports the Board's determination that it would have been obvious to combine Bannuscher and Truppe.

The Board also correctly determined that the "substitute claims" Sirona sought to add are not patentable. Sirona's substitute claims added use of a machine to produce the shape of a drill template such that it has negatives of the neighboring teeth surfaces based on the "three-dimensional optical data" acquired during the planning steps. The Board found that the additional claim requirement for a machine to produce the drill template – including the negatives of neighboring teeth – was well known in the prior art. CAD/CAM milling was a known production technique in the art for producing a dental implant drill template from a 3-D computer model, and CNC milling was a predictable use of a prior art production method according to its established function for producing the drill template.

The Board, however, did err, as a legal matter, in deciding that claims 9-10 are not obvious. In connection with Sirona's Motion to Amend, the Board's factual findings as to the prior art do not depend on the claims being analyzed. As such, these findings apply with equal force to the issued and proposed claims, and when applied to the issued claims, the only proper conclusion is that claims 9-10 are also unpatentable.

ARGUMENT

I. STANDARD OF REVIEW

Obviousness is a question of law based on underlying factual findings, including the scope and content of the prior art references and the existence of a reason to combine references. *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015). The Board's factual findings are reviewed for substantial evidence, while its legal conclusions are reviewed de novo. *Id.* Substantial evidence is "such relevant evidence as a reasonable mind might accept as adequate to support a conclusion." *In re Gartside*, 203 F.3d 1305, 1312 (Fed. Cir. 2000) (citing *Consol. Edison Co. of N.Y. v. NLRB*, 305 U.S. 197, 229-30 (1938)). It is "something less than the weight of the evidence but more than a mere scintilla of evidence." *In re Mouttet*, 686 F.3d 1322, 1331 (Fed. Cir. 2012) (citations omitted). "The possibility of drawing two inconsistent conclusions from the evidence does not prevent an administrative agency's finding from being supported by substantial evidence." *In re Applied Materials, Inc.*, 692 F.3d 1289, 1294 (Fed. Cir. 2012) (alterations omitted) (quoting *Consolo v. Fed. Mar. Comm'n*, 383 U.S. 607, 620 (1966)).

The Board's denial of Sirona's Motion to Amend is reviewed using the standards set forth in the Administrative Procedure Act ("APA"), 5 U.S.C. § 706. *Microsoft Corp. v. Proxyconn, Inc.*, 789 F.3d 1292, 1306 (Fed. Cir. 2015). "Under

that statute, we set aside actions of the Board that are arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law." *Id.* (quoting *In re Sullivan*, 362 F.3d 1324, 1326 (Fed. Cir. 2004)).

II. THE BOARD CORRECTLY DETERMINED THAT CLAIMS 1-8 ARE OBVIOUS

Sirona argues that the Board erroneously found: (1) Bannuscher to disclose measurement of surface structures; (2) Truppe to disclose three-dimensional optical measurements of jaw and teeth surface structure; and (3) a skilled artisan would have been motivated to combine Bannuscher and Truppe. Blue Br. 1. Because the Board's determinations are based on substantial evidence, its judgment of invalidity of claims 1-8 should be affirmed.

A. Substantial Evidence Supports the Board's Factual Finding That Bannuscher Discloses Measurements of Surface Structures

Sirona agrees Bannuscher is directed to planning and making a surgical drill template. Blue Br. 16; Appx662, 1:3-9; Appx1487, ¶ 136. Bannuscher also discloses creating a computer simulation with three-dimensional plaster models of the teeth and jaw, which are digitally transferred to a computer. Appx661, Abstract; Appx663, 3:44-4:7, 7:1-7, 8:36-39; Appx598, ¶ 85; *see* Appx1491, ¶ 142. The computer contains software to permit the dentist to plan the creation of the drill template. Appx665, 8:36-39; Appx598, ¶ 85. Bannuscher produces the drill template by "bring[ing] together the X-ray diagnostics and the model situation

or oral situation of the patient." Appx665, 8:20-23; *see* Appx663, 3:44-4:25; Appx664, 5:6-16; Appx665-666, 8:23-9:30.

Bannuscher recognized that a problem of implant surgery planning is the unavailability of all of the diagnostic data a dental surgeon might desire. Thus, Bannuscher proposed to bring together all of the necessary parameters for the surgical plan in a software simulation. Appx664, 6:24-28; *see* Appx664, 5:40-44; Appx665, 7:38-8:4. To do so, a "three-dimensional model geometry of the oral or jaw region and an X-ray image of the same are entered into a computer digitally." Appx663, 4:3-8; Appx1552-1553, 3:33-4:1.

Straumann's technical expert, Dr. Benjamin, testified that Bannuscher discloses a digitized visual representation of the actual physical proportions of the patient's jaw and teeth with corresponding measured data records obtained from X-ray images. Appx598, ¶ 85. The Board relied on this testimony in reaching its Final Written Decision: "Bannuscher discloses the step of 'correlating' the X-ray data with 3-D data from the plaster model, and the digitized 3-D computer model represents the visual topography of the patient's jaw and teeth, which would include the teeth adjacent the implant position." Appx32 (citing same declaration testimony of Dr. Benjamin (Appx598, ¶ 85)).

Bannuscher thus discloses planning the production of a drill guide, taking an X-ray, creating three-dimensional models of the mouth, and inputting the X-ray

data and three-dimensional models into a computer. This reference therefore discloses every element of claim 1 of the '006 patent except for ***optical*** measuring to obtain the three-dimensional model geometry. Appx33.

1. Sirona's New Argument That Bannuscher Excludes Surface Structure Measurements Is Untimely

Sirona challenges the Board's finding that Bannuscher's three-dimensional plaster models transferred to a computer qualifies as "three-dimensional measuring of the visible surfaces of the jaw and teeth" as claimed in the '006 patent. Blue Br. 42-48. According to Sirona, only data from a "recording bow" is digitally transferred to the computer, and because this device allegedly does not measure surface structures, there is no disclosure in Bannuscher of any measurement of surface structures. *Id.* Sirona's argument should be rejected both on the merits, as explained below, and on procedural grounds because Sirona did not make this argument to the Board.

Bannuscher expressly discloses that "[t]he three-dimensional plaster models and the X-ray image relating to the patient's skull are then input into a computer by digital transfer." Appx665, 8:36-39. Straumann relied on this teaching in its Petition as evidence that "three-dimensional measuring" of surface structures of the models was digitally input as part of Bannuscher's computer simulation. *See* Appx187 ("The 'three-dimensional plaster models and the X-ray image relating to the patient's skull are then input into a computer,' indicating an acquisition of

corresponding measured data records."). Dr. Benjamin also relied on this disclosure in Bannuscher to conclude that surface structures regarding the plaster models were digitally input. Appx598, ¶ 85.

In its Patent Owner Response, Sirona did not attempt to limit Bannuscher to the input of only recording bow data or otherwise dispute that Bannuscher disclosed the input of surface measurements into a computer. Instead, Sirona asserted that Straumann had "tacitly" argued the recording bow/sheet would result in the acquisition of three-dimensional data, and that this tacit argument was supposedly refuted because a recording bow does not measure visible surfaces. Appx314. Sirona specifically did not contest that Bannuscher disclosed *more than* use of the recording bow/sheet. Indeed, Straumann relied on the disclosure that "the three-dimensional plaster models and the X-ray image relating to the patient's skull are then input into a computer by digital transfer." Appx665, 8:36-39.

Sirona's own technical expert, Dr. Erickson, professed a lack of knowledge regarding Bannuscher's disclosure of surface structure data from the three-dimensional models *in addition to* what may have been collected using the recording bow. Despite the significance of this aspect of Bannuscher, Dr. Erickson indicated that he had no opinion on the topic. *See* Appx948-950, 174:6-176:19. Sirona therefore offered no expert testimony or other evidence to dispute

Straumann's showing that measured surface data of a patient's jaw and teeth were input to a computer in the Bannuscher disclosure.

At the final hearing in the IPR, the Board specifically asked Sirona to address the evidence of Bannuscher's three-dimensional measuring of visible jaw and tooth surfaces:

> JUDGE MURPHY: Let me ask you this. In Exhibit 1010 of Bannuscher, right, which is Petitioners' exhibit, in the paragraph following -- immediately following the paragraph that you were raising the issue with the recording bow, right, the translation we've been provided with -- and this is at Exhibit 1010, page 5, column 8, and it begins at about line 36, give or take.
>
> It says: "The three-dimensional plaster models and the x-ray image relating to the patient's skull are then input into a computer by digital transfer." And then it goes on.
>
> Focusing on that particular sentence, ***they're arguing, look, that's telling you that three-dimensional data from the model, from the plaster model that we know was created of the patient's jaw, is being digitally input into the simulation***. So, it's not only the articulation movements. They may well be input, and their point is that's not relevant to the fact that that three-dimensional imaging from the plaster -- or three-dimensional data from the plaster model, right, is being input into the simulation.
>
> MR. OLIVER: So, Your Honor, I think this goes to the point I'm trying to make and which is, yes, there is a plaster model, but these skull simulators which are discussed in Bannuscher are -- have been used in the prior art. They make models of the patient's jaw, and they use -- they are used to put the two pieces of the jaw together and see how they move, the articulation movements. There is a three-dimensional model. It is a skull simulator, meaning measuring skull movement, and they are taking that three-dimensional model and moving it into the computer.

Appx518-519, 62:10-63:13 (emphasis added).

This oral argument was the first time Sirona attempted to distinguish the teachings of Bannuscher that jaw and teeth surface measurements were input to a computer. Sirona's brief in this appeal does not point to any place in the record below where it previously challenged Bannuscher's teaching in this regard. Instead, Sirona had previously argued only that "it is unclear how Petitioners' reliance on a recording sheet/bow is in any way relevant to the claimed measurement of the visible surfaces of the teeth and jaw." Appx314.

In its Final Written Decision, the Board determined that neither Sirona nor Dr. Erickson had challenged Straumann's evidence regarding surface measurements: "Patent Owner does not challenge this evidence." Appx32 (citing Appx310-314; Appx318-323; Appx948-950, 174:6-176:19). The Board thus understood, as did Straumann, that Sirona was not challenging that "[t]he three-dimensional plaster models and the X-ray image relating to the patient's skull are then input into a computer by digital transfer" (Appx665, 8:36-39) qualify as three-dimensional data of the surfaces of the jaw and of the teeth. Sirona's decision to omit this argument prevented Straumann from addressing it before the Board. This Court may therefore consider Sirona to have waived any argument regarding this aspect of Bannuscher. *Fresenius USA, Inc. v. Baxter Int'l, Inc.*, 582 F.3d 1288, 1296 (Fed. Cir. 2009) ("If a party fails to raise an argument before the trial court,

or presents only a skeletal or undeveloped argument to the trial court, we may deem that argument waived on appeal.").

2. The Board Properly Considered Sirona's "recording bow" Argument

Much of Sirona's appeal rests on a supposed distinction – and a supposed relevance of the distinction – between the translations of "Registrierbogen" offered by the parties. Sirona argues that the correct translation of one disclosed instrument is a "recording bow," not a "recording sheet" as in Straumann's translation. Because a recording bow/sheet allegedly cannot measure three-dimensional surfaces of the jaw and teeth, according to Sirona, Straumann failed to establish that Bannuscher disclosed this aspect of the claims. Sirona also argues that Straumann somehow had a burden to identify another "instrument" in Bannuscher that performs such measurements. Blue Br. 50-51. This argument fails for several reasons.

The '006 patent claims do not specify any instrument by which the three-dimensional optical measurements of the jaw and teeth must be acquired. In addition, the '006 patent specification does not identify any instruments at all for acquiring this data or for measuring the surface structures of a patient's jaw and teeth. This point bears repeating. Sirona's appeal argues that Bannuscher does not disclose an instrument for measuring jaw and teeth surfaces even though it expressly describes the digital input of such information into a computer. How this

data is collected, according to Sirona, is a crucial issue. But Sirona's own patent also did not disclose "how" its measurements of jaw and teeth surfaces were obtained. If Sirona's instrumentation point had merit, one surely would have expected its own patent to have provided at least a single example of an instrument to take the claimed surface measurements of the patented method.

More to the point, Bannuscher discloses that a comparison between the location of the prosthetic (tooth or teeth) and the bone supply in the jaw is obtained in the computer simulation. In Bannuscher, the "three-dimensional plaster models" and the "X-ray image" relating to the patient's skull are digitally input into a computer. Appx665, 8:36-39; *see also* Appx597-598, ¶ 84. Bannuscher explains that "[t]he regions which are intended for the supporting zones to be replaced are marked by static measuring points or occlusion reliefs of the ***teeth***." Appx665-666, 8:43-45, 9:1 (emphasis added). This indicates that surface structure of the jaw and teeth is a part of the computer simulation. Bannuscher reinforces that surface structure is input to the computer simulation by further disclosing that the markers on the teeth are "transferred into the X-ray image, as a result of which an immediate comparison is carried out between the optimum position of the teeth and the available vertical bone supply." Appx666, 9:1-6.

Sirona now argues that "[w]hat Bannuscher actually describes is the merging of three-dimensional measurement of the path of movement of the lower jaw

relative to the upper jaw" with X-ray images. Blue Br. 44. To support its argument, Sirona relies on Bannuscher's disclosure of "articulation movements" of the jaw joint being made visible. *Id.* (quoting Appx1554, 5:10-13). This argument is incorrect because it relies on a selective quotation of Bannuscher. The sentences immediately following those quoted by Sirona:

> To structure the prosthetic implant planning in a functional way, ***the entire occlusion structure can be recorded*** and preferably ***all necessary parameters can be combined with one another***. The aimed-for static occlusion can be combined with the available bone to make a static unit.

Appx1554, 5:14-17 (emphasis added). The entire occlusion structure does not refer to path movements alone. Bannuscher also contemplates that digital surface structure is also recorded, *i.e.*, by digitally entering the "[t]hree-dimensional plaster models" into the computer. Appx1555, 6:27-28; *see also* Appx665, 8:36-39.

Sirona additionally contends that Bannuscher's stated purpose is to create a computer model of articulation movements "of the jaw joint . . . in three dimensions." Blue Br. 44 (citing Appx1554, 5:10-13). According to Sirona, "articulation movements of the jaw joint are mapped to the x-ray images of the jaws to visualize movement in the computerized x-ray image." Blue Br. 44. Sirona thus fixates on the recording bow as a device to transfer the articulation of the jaw from the patient's skull to a skull simulator, and, in circular fashion, uses

its own fixation to argue that Bannuscher transfers only recording bow data into the computer simulation.

As noted above, this is a new argument. Sirona's prior briefing left open the possibility that the "three-dimensional plaster models" input digitally into a computer may *not* refer only to articulation data. Dr. Erickson acknowledged this possibility in his deposition.[2] Appx960-962, 188:9-24 (discussing Appx1552-1553, 3:32-4:1 ("Q: So the model geometry data is the three-dimensional geometry data from the plaster models; right? . . . What other model geometry could it be talking about? A: Yeah . . . I'm not particularly sure . . . **It could well mean that**.") (emphasis added)). The Board determined that Sirona did not challenge this Bannuscher disclosure. Appx32 (citing Appx663, 3:44-4:7 (the corresponding translation to Appx1552-1553, 3:32-4:1)).

Sirona's technical expert did not take a definitive position that Bannuscher's model geometry is limited to jaw articulation movements for good reason. According to Bannuscher, "[t]he central idea of the present invention is to bring together the X-ray diagnostics and the model situation or ***oral situation*** of the patient," not just jaw movements. Appx665, 8:20-23 (emphasis added). The

[2] Sirona argues "three-dimensional model geometry" is used consistently "throughout Bannuscher." Blue Br. 53. Dr. Erickson's testimony that "three-dimensional model geometry" could well mean "three-dimensional geometry data from the plaster models" implies global application to Bannuscher's teachings.

Abstract indicates "a three-dimensional model geometry of the ***mouth*** or jaw region" being input digitally, "and in relation to the skull of the patient." Appx661, Abstract (emphasis added). Elsewhere, Bannuscher explains that "the entire occlusion structure" is recorded. Appx664, 6:25-26. And, of course, Bannuscher discloses that the "three-dimensional plaster models and the X-ray image relating to the patient's skull," not just jaw movements, are digitally transferred into the computer simulation. Appx665, 8:36-39.

Contrary to Sirona's argument, the alleged mistranslation of "Registrierbogen" did not cause Straumann to argue that Bannuscher discloses input of surface structure data because of such device. *See* Blue Br. 45. Rather, Straumann relied on Bannuscher's explicit disclosure that surface structure of the jaw and teeth, not just movement in the jaw joint, is digitally input. This is true irrespective of which translation is more accurate. Dr. Benjamin relied on the teachings relating to the patient's "oral situation" to conclude that Bannuscher acquires surface data to plan the production of a drill template. Sirona did not challenge this evidence and the Board's factual determination should be affirmed.

3. Straumann Did Not Shift Any Burden to Sirona

Both Straumann and the Board relied on Bannuscher's disclosure that three-dimensional models are digitally transferred. Appx32; Appx665, 8:36-39. This means that three-dimensional geometry data regarding the teeth and jaw are a part

of the digital data provided to Bannuscher's simulation software. Dr. Benjamin explained that Bannuscher discloses utilization of three-dimensional surface structure to plan the pilot hole in the drill template. Appx600, ¶ 90 ("[T]he drilling areas and drilling angles that position the drilling device in the implantological operation are 'coordinated in respect of an optomised implant position and an available vertical bone supply, ***based on a three-dimensional model geometry of the mouth or jaw region*** and on an X-ray image thereof.'") (emphasis added); Appx601, ¶ 91 ("Based on the correlated x-ray image and 3-D measurement data, a pilot hole is drilled in the drill template."). As the Board determined, surface structure of the three-dimensional plaster models is input through digital transfer. Appx32.

Sirona's "burden shifting" argument therefore relies on an incorrect presentation of the record below. Straumann's Petition established that Bannuscher disclosed "measuring of the visible surfaces of the jaw and of the teeth" as recited in claim 1. Appx194-195. Sirona ignored this evidence in its Patent Owner's Response. Straumann's Reply in support of its Petition, in turn, pointed out that Sirona had ignored all of Bannuscher's input data types. Appx409. The Board agreed that the parties did not dispute this aspect of Bannuscher: "Patent Owner does not challenge this evidence." Appx32.

In this appeal, Sirona nonetheless seizes on the word "ignores" as evidence that Straumann somehow placed on a burden on it to prove a negative. Blue Br. 48-51. The record contradicts this argument. Sirona had an obligation to dispute Bannuscher's teachings, as presented by Straumann, if it had any basis to do so. It should not have ignored the evidence as it did. Sirona's strategy of accepting Straumann's proof did not shift a burden.

Bannuscher, moreover, discloses in the context of implantological and prosthetic planning that "the entire occlusion structure" is recorded such that "as far as possible all necessary parameters can be combined together." Appx664, 6:24-28. To obtain the surgical plan, "the statics of the alveolar process or the verification of stability can be brought into accord with the desired prosthetic provision." Appx664, 6:31-35. In other words, Bannuscher discloses a comparison of the prosthetic tooth (or teeth) to the available bone and nerve structure in the jaw. It further explains that these static parameters "can be recorded in a three-dimensional computer simulation and presented graphically; consequently, information about individual interference patterns can be recognised" and modified as appropriate. Appx666, 7:1-7.

Sirona argues that it "established beyond meaningful dispute that the reference to input information referred to the movement of the 'jaw joint.'" Blue Br. 49. Sirona did nothing of the sort. Sirona instead disregarded Bannuscher's

teachings as to the different types of digital data – including three-dimensional data of the plaster models of the teeth – utilized for computer simulation and modeling of the drill template. Bannuscher produces a drill template by "bring[ing] together the X-ray diagnostics and the model situation or oral situation of the patient." Appx666, 8:20-23. To do so, a "three-dimensional model geometry of the mouth or jaw region and an X-ray image thereof are input digitally." Appx663, 4:3-6.

Bannuscher discloses production of a drill template, whether or not a recording bow/recording sheet is used, as found by the Board. Appx32. The Board's factual finding was supported by substantial evidence. Appx598-599, ¶¶ 85-86; Appx661, Abstract; Appx663, 3:44-4:7, 4:3-21; Appx665-666, 8:36-39, 8:43-9:30.

4. The Board's Factual Findings Regarding "geometry data," "topography," and "marker" Are Fully Supported

Sirona argues that the Board introduced three fundamental misunderstandings of Bannuscher in the Final Written Decision. Blue Br. 51-57. Sirona's argument fails in each instance.

First, Sirona argues the Board incorrectly determined that "3-D geometry of the plaster model" is input into the computer. *Id.*, 52-53. According to Sirona, the "3-D geometry" is the plaster model itself. Sirona claims Bannuscher does not disclose that the surface measurements of the plaster models are input, and that the Board improperly interpreted "three dimensional model geometry" to mean "3-D

geometry" of the jaw and teeth. *Id.*, 53. Sirona concedes that "data relating to the model is input," but states that "that data relates to jaw movement, not surface structures." *Id.*

For the reasons discussed above, Sirona is incorrect. Based on the evidence of record, the Board correctly found that Bannuscher discloses jaw and tooth surface structures to be digitally input into a computer simulation. This is "3-D geometry ***data*.**" Sirona's interpretation of Bannuscher would require model geometry to only refer to physical structures, even *after* it is digitally input to the computer. This makes no sense.

Second, Sirona argues that Bannuscher does not disclose input of "visual topography" of the plaster models as part of the computer simulation. *Id.*, 54. This argument also was not raised in Sirona's Patent Owner Response even though, as acknowledged by Sirona, Straumann had made such an assertion in its Petition. *Id*. That Sirona did not challenge this evidence in its Patent Owner Response provides no basis to do so now.

Sirona's argument regarding "visual topography" also fails on the merits. Straumann established in its Petition that a "three-dimensional relationship of a visual topography of the patient's jaw and teeth" is obtained through a dental impression from which plaster models are prepared. The plaster models provide a visual topography of the patient's jaw and teeth as a digitized three-dimensional

model. Appx597, ¶¶ 84-85; Appx665, 8:36-39. This is substantial evidence that supports the Board's factual conclusions.

Third, the Board did not introduce a new theory by referring to Bannuscher's "markers" to correlate data and determine the optimum positioning of the bore hole and the drilling angles for the pilot hole in the drill template. Blue Br. 55. Based on Bannuscher's disclosure, Straumann advanced this argument in its Petition. Appx187; Appx598-99, ¶ 86. Bannuscher discloses that a comparison between the location of the prosthetic tooth (or teeth) and the bone supply in the jaw is obtained in the computer simulation. Appx598-599, ¶ 86; Appx665-666, 8:43-45, 9:1-10; Appx664, 5:6-16.

In Bannuscher, "[t]he three-dimensional plaster models and the X-ray image relating to the patient's skull are then input into a computer by digital transfer." Appx665, 8:36-39. Additionally, "[t]he regions which are intended for the supporting zones to be replaced are marked by static measuring points or occlusion reliefs of the ***teeth***." Appx665-666, 8:43-45, 9:1 (emphasis added). The surface structure of the jaw and teeth is therefore a part of the computer simulation. Bannuscher reinforces that surface structure is provided to the computer simulation by disclosing that "[a]t the same time, these regions are transferred into the X-ray image, as a result of which an immediate comparison is carried out between the optimum position of the teeth and the available vertical bone supply." Appx666,

9:1-6. Therefore, contrary to Sirona's argument, the Bannuscher computer simulation discloses a comparison of the digital representation of teeth and the bone supply in the jaw in which the implant will be located.

Sirona also did not fairly characterize Straumann's expert testimony. According to Sirona, Dr. Benjamin testified that marking is performed by radiopaque markers, which show up on the X-ray. Blue Br. 56 (citing Appx1788-1789, 135:8-136:17). Dr. Benjamin, however, also testified that markers and reference points are used to coordinate positions in the 3-D model geometry data and the X-ray image. Appx598-599, ¶ 86; Appx600, ¶ 90. Dr. Benjamin's testimony is consistent with Bannuscher, as the Board found. Appx27; Appx665-666, 8:43-9:30; Appx663, 4:3-21.

After the three-dimensional plaster models are digitally input, markers are placed on the teeth by "static measuring points or occlusion reliefs of the teeth." Appx665-666, 8:43-9:1. And, "[a]t the same time, these regions are transferred into the X-ray image, as a result of which an immediate comparison is carried out between the optimum position of the teeth and the available vertical bone supply." Appx666, 9:1-6. Bannuscher thus discloses a comparison between the teeth and the potential location at which the implant will be secured into the jaw. Appx598-599, ¶ 86.

5. The Board's Factual Findings Regarding "3-D geometry data" Were Not a New Theory

Sirona argues that the Board introduced a new theory regarding "geometry data" in the Final Written Decision. Blue Br. 68-69. Straumann's briefing, however, included the exact words "three-dimensional model geometry data." Appx410. Dr. Erickson also provided testimony regarding such data at his deposition. Appx948-950, 174:6-176:13; *see also* Appx959-962, 185:17-188:24. As a procedural matter, Sirona's argument is simply mistaken.

Sirona's "new theory" argument also misses the mark on the merits. Straumann consistently contended that surface data for Bannuscher's three-dimensional models were digitally input as part of Bannuscher's computer simulation. Whether that concept is referred to as "three-dimensional plaster models," "three-dimensional surface structure," or "3-D geometry model data" made no difference. That Sirona did not challenge Straumann's evidence on this issue, as found by the Board (Appx32), should not now provide Sirona a vehicle to reargue the issue.

B. Substantial Evidence Supports the Board's Factual Finding That Truppe Discloses "three-dimensional optical measuring"

In its Institution Decision, the Board construed the claim limitation "carrying out a three-dimensional optical measuring of the visible surfaces of the jaw and of the teeth," under its broadest reasonable interpretation, to mean "using light to

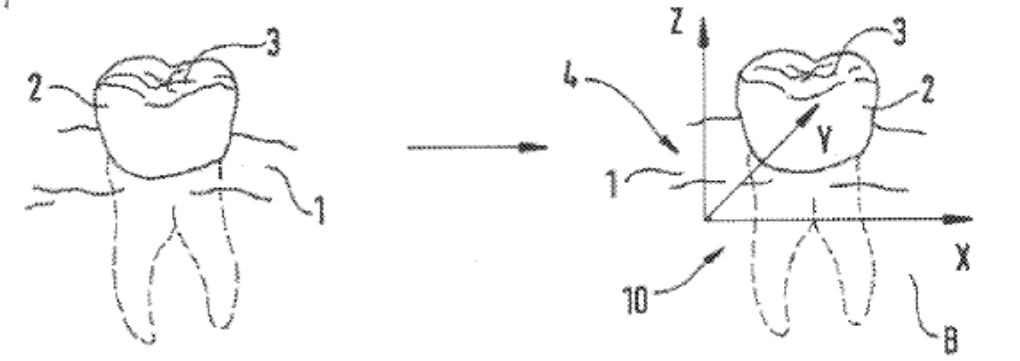
measure the visible surfaces of the jaw and teeth in three dimensions." Appx248-249. The Board did not specify a particular type of recording instrument or camera device to be required for the optical measuring. Moreover, the Board's claim construction did "not require the camera itself to measure the surface structures of the jaw and teeth directly in three dimensions." Appx34. Sirona does not challenge this construction.

The Board's construction is of course consistent with the '006 patent specification, which also does not specify the type of recording instrument or camera device to conduct the optical measuring. The '006 patent specification indicates only that FIG. 2 shows the "schematic depiction of a three-dimensional image of a molar 2" that is "measured using a three-dimensional system of coordinates." Appx62, 3:50-53. At the time of Sirona's patent filing, and well more than a year before, three-dimensional optical measuring of the visible surfaces of the jaw and of the teeth was a well-known art. This point cannot be reasonably disputed.

Sirona also does not challenge the Board's determination that Truppe discloses optical measuring of the visible surfaces of the jaw and of the teeth. Sirona instead argues that Truppe does not disclose "3-D optical measuring." Blue Br. 59. Sirona contends that neither Straumann nor the Board explained how a "conventional 2-D camera" (with three-dimensional sensors) "captures 3-D images

or is used for 3-D optical measuring." *Id.* Sirona ignores that its own patent also does not provide such explanation. Figure 2 of the '006 patent (Appx59; reproduced below) shows optical measurements with reference to the x-y-z coordinate system, like the three-dimensional coordinate system used by Truppe to re-position dental structures in three dimensions based on the position or movement of the teeth and jaw relative to the video camera. Appx657, 3:65-4:1-5; Appx599, ¶¶ 87-88.

FIG. 2



Sirona's argument that Truppe is not used for "3-D optical measuring" disregards Truppe's disclosure regarding matching of surface structure with X-ray (CT) data. CT data are aligned with optical image data "such that the structures of the [CT] data set always still match, *i.e.*, remain in agreement with, the corresponding structures of the optical image, even if the jaw should move three-dimensionally." Appx657, 3:22-28. Truppe therefore optically measures the teeth and jaw surfaces with reference to a three-dimensional coordinate system based on

the relative positions of the 3-D sensors. Appx35; Appx656, 2:47-52; Appx658, 6:8-12; Appx655, FIG. 4. The Board correctly determined that Truppe's optical measurements are taken with reference to a three-dimensional coordinate system; otherwise, the dental structures in the optical image cannot "be matched in a 'positionally correct' way with the 3-D X-ray image data, particularly when the jaw moves relative to the camera in three-dimensional space."[3] Appx36-37. Sirona does not explain how, without measurements, the structures possibly could be matched.

The optical representation of the surface structures is defined relative to a three-dimensional coordinate space to align it in a different three-dimensional coordinate space with CT image data. Truppe uses locations of the jaw and teeth in the three-dimensional coordinate space to determine not only the angle of view of the camera, but also for calculating the appropriate scale of the object, *i.e.*, the scale of the jaw and teeth. Appx657, 3:65-4:1; *see* Appx657, 4:60-64; *see also* Appx658, 6:2-4. Because the scale and camera viewing angle are determined, "[t]he corresponding structures of the optical representation and from the picture of the imaging process thus coincide and can be represented in their correct position

[3] Sirona criticizes Dr. Benjamin's deposition testimony regarding the optical nature of Truppe's sensors. Blue Br. 22. The Board did not rely on this deposition testimony in reaching its conclusion; instead it relied on Dr. Benjamin's testimony regarding how Truppe creates an optical 3-D model. Appx35-36 (citing Appx591-592, ¶¶ 69-70).

simultaneously or alternatively." Appx657, 4:1-5. Truppe's three-dimensional sensors enable the optical measuring data to be positionally aligned with the X-ray data.

Sirona now argues that Truppe does not meet the three-dimensional optical measuring requirement because "there is never any optical data that is scaled." Blue Br. 61. This is incorrect. By "carrying out a number of coordinate transformations," the structures of the X-ray data set always match the structures of the optical data. Appx657, 3:22-28. The coordinates of the optical data are required to coincide with the X-ray data set such that they are "positionally correct" due to Truppe's optical measurements being determined relative to a three-dimensional coordinate system. Appx36. This qualifies as "three-dimensional optical measuring" under either a conventional understanding of this term or under the Board's broadest reasonable construction of it.

Sirona's argument that Truppe's 3-D sensors "measure position only, and not surface structures" loses sight of the remaining elements in Truppe. *See* Blue Br. 60. As the Board determined, the 3-D sensors together with the captured video enable the calculated representation of the surface structures located in 3-D coordinate space to be aligned in a different 3-D coordinate space (based on the relative positions of the sensors) and to be further aligned in a different 3-D coordinate space (based on the marking points) with X-ray (CT) image data.

Appx35-36 (citing Appx591-592, ¶¶ 69-70). Sirona does not challenge these findings by the Board. Nor does Sirona challenge the Board's finding that "Truppe's goal – improving implant surgical planning by superimposing X-ray image and optical image data sets in a 'positionally correct' and 'vivid way' – is accomplished by using coordinate transformations in 3-D coordinate systems based on the relative positions of the marking points and magnetic sensors." Appx36. Because Truppe optically measures the surface structures by defining the structures relative to three-dimensional coordinates, Truppe uses light to measure the visible surfaces of the jaw and teeth in three dimensions.

The Board construed "carrying out a three-dimensional optical measuring of the visible surfaces of the jaw and teeth" to mean "using light to measure the visible surfaces of the jaw and teeth in three dimensions." Appx34; Appx248-249. Sirona does not challenge this construction. Truppe uses light to measure the dental structures in three dimensions, such that the dental structures are positioned relative to three-dimensional coordinates to permit alignment with the X-ray data. Appx36-37; Appx657, 3:12-23, 4:33-37. The Board's determination that Truppe meets the claim requirement of "carrying out a three-dimensional optical measuring of the visible surfaces of the jaw and of the teeth" because Truppe's camera system captures surface structures in a three-dimensional coordinate space is supported by substantial evidence.

C. Substantial Evidence Supports the Board's Factual Finding of a Motivation to Combine Bannuscher and Truppe

The Board found that a skilled artisan would have been motivated to combine Bannuscher and Truppe to yield the subject matter of claims 1-8. In reaching this conclusion, the Board relied on the disclosure in Truppe that "positionally correct" three-dimensional optical data and X-ray data sets should be used for surgical planning of dental implants, as well as the testimony of Dr. Benjamin regarding the motivation to combine based on Truppe's teachings. Appx37-42.

The Board's findings identify reasons for the motivation to combine based on the teachings in Bannuscher and Truppe themselves. Sirona's reliance on *In re NuVasive, Inc.*, 842 F.3d 1376 (Fed. Cir. 2016), is therefore misplaced. There the Court required the Board to do more than simply adopt one party's arguments, based on expert testimony regarding the benefits recognized after the invention, as to the motivation to combine. *See id.* at 1384.

Sirona argues that the Board erred in finding a motivation to combine Bannuscher and Truppe because, according to the Board, Bannuscher discloses measurement of visible surface structures even though they are not an "optical measurement." Blue Br. 58. Sirona also contends that the Board should not have relied on Bannuscher's disclosure of the "desire to obtain 'all the necessary [clinical] parameters' relevant to pre-surgical implant planning" without specifying

what those "necessary parameters" should include. *Id.* Sirona's arguments fail for several reasons.

First, Sirona's argument that Bannuscher does not disclose measurement of visible surface structure is incorrect for the reasons explained above. And, Sirona's argument that there is "nothing in Bannuscher for which an optical measurement could be substituted" was expressly rejected by the Board: "Petitioner's argument regarding Truppe does not propose substituting Truppe's camera in place of Bannuscher's recording bow as postulated by Patent Owner." Appx39. In addition to the expert testimony of Dr. Benjamin, the Board considered the teachings of Truppe and Bannuscher themselves. Appx40 (citing Appx599, ¶ 89, Appx601-602, ¶ 92; Appx656, 1:10-11; Appx664, 5:19-25).

Sirona also does not challenge the Board's determination that Bannuscher and Truppe are directed to the same implant planning technology. Appx39-40. In setting the context of the invention, Truppe explains "[w]hen dental implants are prepared, precise planning of the surgical operation is necessary." Appx656, 1:10-11. Bannuscher, on the other hand, discloses carrying out "all of the implant planning, treatment planning, and operation planning" in such a way that "integrated planning results can be precisely implemented clinically," as the Board found. Appx40 (citing Appx664, 5:19-25, but quoting Appx1553, 4:27-29). Both

Bannuscher and Truppe require planning and modeling of the patient's jaw and teeth prior to the actual implant procedure, as the Board also found. Appx38.

Sirona further ignores the testimony of Dr. Benjamin that a skilled artisan would have been motivated to combine Bannuscher and Truppe based on the enhancement of "positionally correct" data sets. Appx600-601, ¶¶ 91-92. This expert explained that Truppe actually discloses how to correlate three-dimensional optical surface data with X-ray data so that the dental structures of the data sets "match" or "remain in agreement" with each other. Appx592, ¶ 70; Appx657, 3:24-26. He also explained how a skilled artisan would recognize the benefit of comparing an actual jaw to a model, as disclosed by Truppe, to assist in Bannuscher's implant planning method. Appx599, ¶ 89; Appx657, 3:56-60. He further explained how a skilled artisan would have been motivated to use the image enhancements provided by Truppe, particularly as they provided "vivid" comparison between the patient's mouth and the model thereof. Appx1839-1840, 186:8-187:13; Appx1844-1847, 191:9-194:5; *see* Appx656, 2:7-16.

Dr. Erickson also supported the Board's determination. He acknowledged a desirability to obtain as much diagnostic information as possible in planning an implant surgery. Appx805, 31:12-21.

Sirona now criticizes the Board for determining that:

> Bannuscher discloses the desire to obtain 'all the necessary [clinical] parameters' relevant to pre-surgical implant planning, which can be 'combined together' ('correlated' in the language of claim 1) using planning simulation software, for transfer to a drill template.

Blue Br. 58 (quoting Appx40). Bannuscher discloses that such parameters include recording "the entire occlusion structure," the "static occlusion," and the "available bone supply" in the jaw so that the "desired prosthetic position," that is, the desired placement of the new tooth (or teeth) may be surgically planned. Appx664, 6:25-35. That the Board did not repeat the clinical parameters identified by Bannuscher does not negate its factual conclusions. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 419 (2007) (suggesting that insights relevant to resolving obviousness "need not become rigid and mandatory formulas"). Sirona's suggestion that the Board needed to invoke particular language in its analysis is therefore unavailing.

Sirona incorrectly argues that Straumann relied "exclusively" on the measurement of visible surface structures in Bannuscher for the combination with Truppe. Blue Br. 58. Straumann also argued that a skilled artisan would have understood the benefit of utilizing the superimposed data sets of Truppe in Bannuscher to compare an optical image of the actual jaw and a model of the jaw, together with Bannuscher's teachings that "all necessary [clinical] parameters" should be brought together in the planning software. Appx188-189. This provides an independent basis to combine Bannuscher with Truppe, as the Board determined. Appx40. And as the Board found, Truppe optically measures the

visible surfaces of a patient's jaw and teeth using light and with reference to a three-dimensional coordinate system. Appx35. Even assuming Sirona were correct that Bannuscher measures jaw joint movement alone – which Sirona is not – substantial evidence supports the Board's determination that a skilled artisan would have been motivated to combine Bannuscher and Truppe.

As the Board found based on substantial evidence, Bannuscher discloses a desire to obtain all relevant clinical data in planning simulation software to produce a drill template. Appx664, 5:44-6:13. And Truppe discloses an advantage to utilizing correlated radiological data and three-dimensional optical measurement data of the actual jaw and teeth to compare them to a model of the jaw and teeth. Truppe and Bannuscher thus converge on a common goal. Appx599, ¶ 89. The motivation to combine the references would be to obtain additional diagnostic data to enable comparison, in Bannuscher's planning simulation software, of the actual jaw and teeth to a model of the jaw and teeth. Appx1839-1840, 186:8-187:13; Appx599-602, ¶¶ 89-92. Truppe's technique to improve Bannuscher in this manner is therefore obvious because "the skilled artisan [is] able to recognize, based on her background knowledge, [the technique's] potential to improve the [method of Bannuscher] and [is] able to apply the technique." *Unwired Planet, LLC, v. Google Inc.*, 841 F.3d 995, 1003-4 (Fed. Cir. 2016). Indeed, the Board stated "that a POSA *would have* had reason to incorporate the teaching of Truppe's

enhanced 3-D optical measurement technique into Bannuscher's method for correlating 3-D X-ray image and model geometry data sets, to determine an optimal bore hole and corresponding pilot hole in the drill template." Appx41 (emphasis added). The Board provided ample rationale to explain why "a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention." *Belden*, 805 F.3d at 1073 (emphases in original).

Sirona nonetheless argues for *de novo* review of the Board's factual conclusions. It argues for a different conclusion based on the same facts because the Board allegedly did not provide adequate support for how the combination of Bannuscher and Truppe would have been made. Blue Br. 58-59. Sirona's narrow focus on Truppe's and Bannuscher's specific embodiments is "a rigid approach to determining obviousness based on the disclosures of individual prior-art references, with little recourse to the knowledge, creativity, and common sense that an ordinarily skilled artisan would have brought to bear when considering combinations or modifications." *Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013) (citing *KSR*, 550 U.S. at 415-22). Sirona presents no persuasive evidence that combining the teachings of Truppe and Bannuscher would involve some sort of technological incompatibility or be "uniquely challenging or difficult

for one of ordinary skill in the art." *Leapfrog Enters., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007) (citing *KSR*, 550 U.S. at 418).

The Board provided a reasoned explanation to conclude that claims 1-8 are invalid for obviousness. The Board's analysis relied on factual determinations that are supported by substantial evidence, and the Board's ultimate determination of obviousness should be affirmed.

III. THE BOARD CORRECTLY DENIED SIRONA'S MOTION TO AMEND

The Board correctly denied Sirona's Motion to Amend to add its substitute claims 11-18 because Sirona failed to establish that these claims are patentable. The Board's determination that the substitute claims are obvious was based on substantial evidence.

A. Sirona Failed to Show Patentability of Its Substitute Claims

Sirona was required to establish that it was entitled to the claim amendment sought. *Prolitec, Inc. v. Scentair Techs., Inc.*, 807 F.3d 1353, 1363 (Fed. Cir. 2015) (discussing how the Court's decision in *Microsoft*, 789 F.3d 1292, forecloses argument that a patentee in an IPR does not bear the burden to show patentability of proposed claim amendments); *see* 37 C.F.R. § 42.20(c). The Board did not abuse its discretion in denying Sirona's Motion for the reason that its proposed claims 11-18 are obvious.

B. The Board Correctly Determined That Substitute Claims 11-18 Are Obvious

In the substitute claims, Sirona added to claim 1 the requirement of "producing the drill template containing the pilot hole and negatives of the surfaces of the neighboring teeth, wherein the negatives of the surfaces of the neighboring teeth are formed by a machine based on the measured data record obtained from the optical measuring in the carrying out step." Appx333. This additional claim requirement does not confer patentability to the amended claims.

1. Substantial Evidence Supports the Board's Factual Findings Regarding the Combination of Bannuscher/Truppe with Poirier and Klein

Sirona argues Straumann provided no new evidence regarding the additional step added to substitute claim 11. The record, however, contained more than sufficient evidence that claim 1 is obvious over Bannuscher and Truppe, as explained by the Board. Appx25-42; Appx48. Substantial evidence showed that the additional step proposed by the amendment was known to persons of skill in the art prior to the critical date.

The Board recognized that Bannuscher discloses creating a drill template formed to match the occlusal surfaces of the teeth, and would therefore include negatives of neighboring tooth surfaces, as the amendment required. Appx49. The Board also recognized that Klein discloses a conventional implant drill implant template, which also includes the negatives of neighboring tooth surfaces.

Appx49-50. For example, as shown in FIG. 23 of Klein (Appx677), anchors on the drill template match the neighboring teeth. Appx51. Dr. Benjamin so testified, and Dr. Erickson did not dispute that testimony. Appx49-50 (citing Appx763, ¶ 16; Appx1140, 72:9-16). For a partially edentulous case, in which teeth are still present in the patient's jaw, a skilled artisan would have understood that a conventional drill template would have the form disclosed by Klein. Appx51 (citing Appx765, ¶ 20).

The Board also recognized the teachings of Poirier regarding Sirona's proposed claims that "the negatives of the surfaces of the neighboring teeth are formed by a machine based on the measured data record obtained from the three-dimensional optical measuring in the carrying out step." Appx52-53. Poirier relates to planning and producing both a drill template and a superstructure on which the template is located. In Poirier, the drill template is produced based on correlated X-ray imaging data and optical scanning data.[4] Appx1633; Appx1636, FIG. 5; Appx1644, 4:63-65; Appx761-762, ¶¶ 11-12.

[4] Sirona wrongly argues that "radiographic data, and not optical data, is used to design the drill template." Blue Br. 66. Poirier discloses both radiographic data and optical data being used. Appx1636, FIG. 5; Appx1644, 3:56-60; Appx1645, 6:19-22; Appx761-762, ¶¶ 11-12. The Board declined to resolve this dispute because it relied on the combination of Bannuscher and Truppe for the relevant disclosure. Appx53 n.24.

Poirier's drill template may be produced either by using a CNC milling machine or by using a molding process. Appx1644, 3:48-56.

> While it would be possible to ***prepare the drill template body and provide it with the drill guide sockets using the CNC device***, ***the drill template body is preferably molded*** on a physical model of the gum surface into which model the CNC device has previously drilled the desired implant drill holes. The drill holes in the physical model are used to build a mold for the drill guide sockets. This prevents the need to use the CNC device to ***produce fine details*** except for the precision drilling of the drill holes.

Id. (emphases added). Sirona argues that Poirier refers only to producing the drill guide sockets using a CNC device, not the drill guide body and the sockets. This is untrue. The "fine details" of the drill guide body are seen with reference to FIGS. 10-11 (Appx1639; reproduced below). Figure 10 shows a front view of a physical model of a patient's mouth 21 into which holes 58 are drilled. Appx1645, 6:59-62. The physical model has a contour surface (denoted in yellow) onto which the drill guide body is placed.

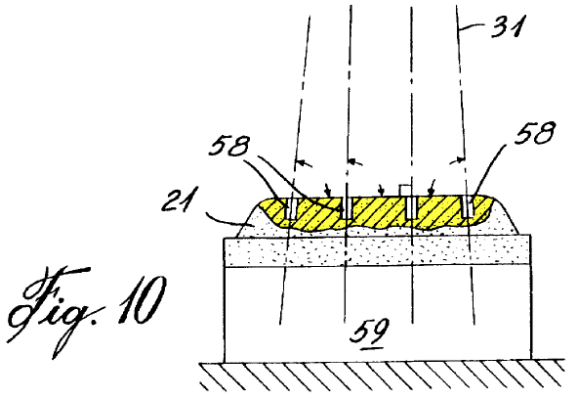


Fig. 10

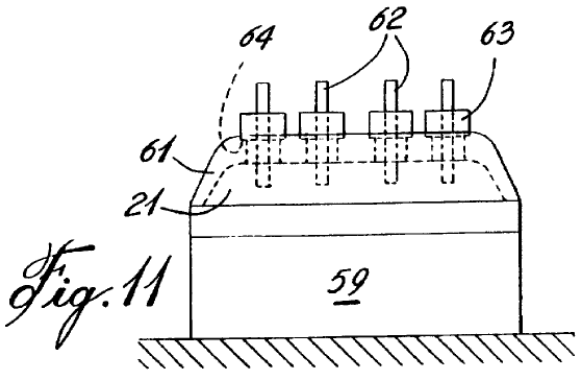


Fig. 11

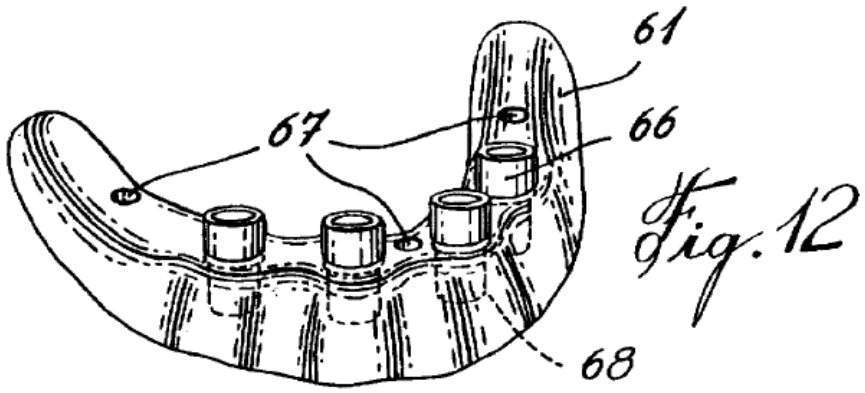


Fig. 12

Appx1639, FIGS. 10-12. Figure 11 shows the drill guide body 61 now placed onto the physical model such that it matches the surfaces of the jaw as a negative. Appx1645-1646, 6:63-7:6. The "fine details" of the drill guide body are also the exterior surfaces shown in FIG. 12.

Sirona argues that the Board and Straumann should not have relied on Poirier to describe the formation of negatives in a drill template. Blue Br. 63. It also takes issue with the Board's "plain reading" of Poirier. Appx52. Sirona's own reading of Poirier, however, is contrary to Poirier's teachings, and to Dr. Benjamin's testimony, which the Board credited. Appx52, n.23; Appx761-762, ¶ 12; Appx1644, 3:48-56. The Board considered and properly rejected Sirona's strained reading of Poirier's plain teachings. To the extent there is any factual dispute on this point, Sirona's present arguments cannot erase the substantial evidence supporting the Board's conclusion.

The Board also cited other prior art of record to find that CNC milling was known in the art as a computer-controlled machine process that uses digitized input

data for a variety of dental applications. Appx53. For example, both technical experts agreed Willer discloses the use of CAD/CAM milling through digitization of a prepared tooth surface and conversion of the data into control signals for computer-assisted milling. Appx52; *see* Appx762, ¶¶ 14-15; Appx1447-1448, ¶ 58. Dr. Benjamin provided expert testimony that Willer discloses three-dimensional scanning and digitization that enables creation of a "point cloud" describing the surface, which can be used directly to generate a CAD model and to describe milling paths. Appx762, ¶ 15.

Sirona does not challenge the Board's finding that the computer graphics model in Bannuscher would have included the digital data based on the correlation of 3-D X-ray image data and optical image data of the jaw and teeth modeled in Bannuscher (and disclosed in Truppe), for use in producing a dental implant drill template. Appx53 (citing Appx591-592, ¶¶ 69-70; Appx657-658, 3:12-27, 3:47-4:5, 5:63-6:4). Accordingly, substantial evidence supports the Board's finding that Bannuscher and Truppe disclose the "measured data record obtained from the three-dimensional optical measuring in the carrying out step." Appx53.

2. Substantial Evidence Supports the Board's Factual Finding of a Motivation to Combine Bannuscher/Truppe with Poirier and Klein

The Board relied on the evidence of record, including Poirier and Willer, to conclude use of CNC milling machines was known in the art. Appx53-54. The

Board also credited Dr. Benjamin, who testified that a skilled artisan would have understood that use of CNC milling apparatus was an obvious design choice in light of Bannuscher's teachings regarding the diagnostic information obtained and the coordination of a simulated plan with X-ray radiological data. Appx1766-1767, 113:10-114:21. A skilled artisan therefore would have understood how to make a drill template, such as disclosed by Bannuscher or Klein, through use of a CNC milling machine. Appx54. There was sufficient evidence to establish the obviousness of the substitute claims. *See KSR*, 550 U.S. at 421 ("When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has good reason to pursue the known options within his or her technical grasp.").

The Board applied the obviousness framework set out by the Supreme Court in *KSR*. *See id.* at 415-24. The touchstone of obviousness is whether "a person of ordinary skill can implement a predictable variation." *Id.* at 417. When determining whether an invention that combines previously known elements is patentable, "a court must ask whether the improvement is more than a predictable use of known prior art elements according to their established functions." *Id.* In *KSR*, the Court explained that a person of skill in the art was not narrowly limited to the four corners of the prior art references, but rather the "proper question to have asked was whether a pedal designer of ordinary skill, facing the wide range of

needs created by developments in the field of endeavor, would have seen a benefit" in modifying the prior art reference to include the features claimed in the patent-in-suit. *Id.* at 424.

The only question raised by the substitute claims was whether a skilled artisan, faced with the teachings of Bannuscher and Truppe, would have been motivated to use a CAD/CAM milling or grinding machine to produce the drill template, such as disclosed by Poirier. The Board properly used Klein to confirm that the structure of the drill template of Bannuscher contains negative surfaces of the neighboring teeth. Appx51-52.

The Board provided analysis and explanation for why a skilled artisan would have used the drill template planning method explicitly taught by Bannuscher to produce the operation template using a CAD/CAM milling device. Appx48-52. The Board credited unrebutted evidence that a skilled artisan would have readily understood how to combine those references to yield the claimed invention. Its conclusion that the substitute claims are obvious was based on substantial evidence and should be affirmed. Appx54-55.

C. Sirona Had Adequate Notice Regarding the Obviousness of Substitute Claims 11-18

Sirona contends that it lacked adequate notice of the Board's reasons for determining that substitute claims 11-18 are unpatentable. Blue Br. at 68-69. The authority relied on by Sirona does not support its contention. In concluding

Sirona's proposed claims are unpatentable, the Board relied on the same references at issue in the IPR. Accordingly, Sirona was not "taken by surprise by the Board's reliance on an entirely new reference or was not given adequate notice and opportunity to present arguments distinguishing that reference." *Prolitec*, 807 F.3d at 1365 (citing *Microsoft*, 789 F.3d at 1308).

Straumann addressed the unpatentability of claims 1-10 of the '006 patent as obvious based on the combination of Bannuscher and Truppe. Appx186-199. The Board's decision on institution was based in part on the same combination. Appx259-260. Straumann also addressed Poirier and Klein in its Opposition to the Motion to Amend (Appx370-372), and both of those references were addressed by Sirona in its Reply (Appx427-429). Sirona's lack-of-notice argument with respect to the Motion to Amend therefore lacks merit. It had an opportunity to address all of these references either in the Motion to Amend or in the Reply. Sirona's reliance on *In re Magnum Oil Tools International, Ltd.*, 829 F.3d 1364 (Fed. Cir. 2016), is therefore misplaced. *See* Blue Br. 68-69. *Magnum* addresses burden-shifting in the context of *un*patentability of a challenged patent claim where the burden of persuasion is on the petitioner. 829 F.3d at 1375-77. *Magnum* does not refer to motions to amend.

Sirona relies on *SAS Institute, Inc. v. ComplementSoft, LLC.*, 825 F.3d 1341 (Fed. Cir. 2016), for the proposition that the Board improperly "changed theories

midstream," and in so doing deprived Sirona of the notice it was entitled to under the APA. Blue Br. 69. During the IPR discussed in *SAS*, the Board adopted a construction of a term in the institution decision, but then altered the construction in the final written decision, while at the same time finding a number of claims invalid based on the new construction. 825 F.3d at 1346. In *SAS*, the petitioner argued that adoption of a new claim construction in the final written decision left the parties without an opportunity to respond, *id.* at 1347, and this Court agreed. *Id.* at 1351-52. Here, Sirona did not rely on an initial tack of the Board that "changed [] midstream," as the burden (both of persuasion and initial production) was on Sirona. Sirona did not meet its burden, as the Board found.

D. In the Alternative, Remand Is Required

Contrary to Sirona's call for straight reversal (Blue Br. 70), in the event that the Court does not affirm the Board's denial of Sirona's Motion to Amend, the Court should remand for the Board's consideration of additional grounds that the substitute claims are not patentable.

Because the Board determined the substitute claims are obvious based on one prior art combination, the Board did not consider additional grounds for denying the Motion to Amend raised by Straumann. For example, the Board did not consider whether the substitute claims are obvious in view of other prior art combinations, such as Mushabac, Poirier, Willer, and Klein (*see* Appx373-374), or

Mushabac, Swaelens, and Klein (*see* Appx374-376). The Board also did not consider whether the substitute claims are invalid under 35 U.S.C. § 112. *See* Appx376-383. Although these additional grounds further demonstrate why the Board's ultimate decision to deny Sirona's Motion to Amend was correct, this Court should not review those grounds because they formed no part of the Board's decision on the Motion to Amend. *SEC v. Chenery Corp.*, 332 U.S. 194, 196 (1947) ("[A] reviewing court, in dealing with a determination or judgment which an administrative agency alone is authorized to make, must judge the propriety of such action solely by the grounds invoked by the agency."); *In re Applied Materials*, 692 F.3d at 1294 ("The Board's judgment must be reviewed on the grounds upon which the Board actually relied."). If the Board's denial of Sirona's Motion to Amend is vacated, then, at a minimum, consideration of these issues by the Board on remand is appropriate.

IV. THE BOARD ERRED IN DETERMINING THAT CLAIMS 9-10 ARE PATENTABLE

Although the Board correctly found that claims 1-8 of the '006 patent are unpatentable, it legally erred in concluding otherwise regarding claims 9-10. Claim 9 depends from claim 1, and adds only the following limitation: "wherein the drill assistance device is ***ground out from a dimension-stable material***, and said material represents the form of occlusal surfaces of neighboring teeth as a negative with respect to an implant position." Appx63, 6:17-21 (emphasis added).

The Board found that use of machines to make the drill assistance device was known in the context of denying Sirona's Motion to Amend. It should have, but did not, apply this finding to claims 9-10. These claims are obvious when the evidence established a person of ordinary skill in the art would have understood such a modification of Bannuscher to have been a routine and predictable design choice. Appx42-45.

This situation is somewhat unique. Sirona invited – through the submission of its Motion to Amend – the finding of additional facts by the Board regarding the scope and content of the prior art, and the knowledge of those skilled in the art of implant drill template planning and production. *See* Appx52-55. As the party with the burden of proof, Sirona had every incentive to establish that its substitute claims were patentable. The facts determined by the Board in the context of the Motion to Amend established not only that Sirona's proposed substitute claims are obvious, but they confirmed that issued claims 9-10 are also obvious.

The Board's conclusion that claims 9-10 are not obvious should be reversed or, at the very least, vacated and remanded.

A. The Scope of Dependent Claim 9 and Substitute Claim 11

The '006 patent specification refers to grinding out the drill template with a "CAD/CAM unit." Appx62, 3:13-17. Sirona's technical expert, Dr. Erickson, confirmed that the phrase "ground out from a dimension-stable material" refers to

removal of material by grinding or cutting operations, such as by a CAD/CAM unit. Appx1445, ¶ 53. He further explained that a skilled artisan would have understood claim 9 to refer to a process where the dimension-stable material is ground away to form a relief pattern that represents negatives of the neighboring teeth surfaces. Appx1448, ¶ 59. While it does not specify that the drill template is necessarily ground out by a machine, claim 9 certainly covers drill templates that are ground out by a machine, such as a "CAD/CAM unit," to form the negatives of the neighboring teeth surfaces.

Substitute claim 11, on the other hand, specifies that the drill template is formed by a machine based on the measured data record obtained from the three-dimensional optical measuring in the carrying out step. Appx354-355. Sirona relied on the "possible to grind out on a CAD/CAM unit an implant assistance device" language in its patent application as written description for the additional limitation in substitute claim 11. Appx338 (citing the file history of the '006 patent, Appx701-702, 4:3-5:1). Substitute claim 11, therefore, covers drill templates that are ground out to form the negatives of neighboring teeth surfaces, such as on a "CAD/CAM unit," and drill templates that are produced by other machining operations.

B. The Facts Determined by the Board in Its Denial of Sirona's Motion to Amend Establish the Unpatentability of Claims 9-10

In the context of Sirona's Motion to Amend, the Board concluded:

- "CNC milling was a known production technique within a POSA's knowledge and skill level for producing a dental implant drill template from a 3-D computer model, such as the 3-D computer model described in Bannuscher and Truppe;" and
- "CNC milling was nothing more than the predictable use of a prior art production method according to its established function for producing the drill template disclosed in Bannuscher and Klein."

Appx55. Substantial evidence supported these findings. There can be no genuine dispute that using CNC milling to produce a dental implant drill template from a 3-D computer model described in Bannuscher and Truppe satisfies claim 9's requirement that "the drill assistance device is ground out from a dimension-stable material, and said material represents the form of occlusal surfaces of neighboring teeth as a negative with respect to an implant position." Appx63, 6:17-21. Bannuscher discloses a conventional drill template for a partially edentulous case, which contains negatives of neighboring teeth surfaces. Appx51-52. The Board nevertheless failed to apply its own findings to claims 9-10 because Straumann had not presented such evidence or advanced argument supporting these specific grounds in its Petition.

In this instance, the Board had an independent obligation to find claims 9 and 10 unpatentable regardless of whether Straumann presented the specific

combination of references upon which it relied. This is because Sirona alone injected the patentability issue regarding use of a CAD/CAM milling machine to form negatives of occlusal surfaces of a drill template, *e.g.*, grinding out from a dimension-stable material to form the drill assistance device as in issued claims 9-10, through the presentation of Sirona's substitute claims 11-18. In deciding the Motion to Amend, the Board found additional facts that also apply to issued claims 9-10. A party that elects to put a patentability question at issue with respect to proposed substitute claims, such as whether it would have been obvious to use a CAD/CAM machine to form the drill template surfaces, should not be heard to complain if the result reaches beyond those claims. *See, e.g.*, *Gundlach v. Int'l Bus. Machs. Inc.*, 594 F. App'x 8, 10 n.1 (2d Cir. 2014) (in a motion to dismiss, permitting reliance on facts determined in a personal jurisdiction motion because it had "placed the burden of persuasion on the plaintiff, who therefore had every incentive and opportunity to produce relevant evidence" and thus satisfied the purpose of the notice requirement). Therefore, the grounds for determining that substitute claims 11-18 are obvious should apply equally to issued claims 9-10 of the '006 patent.

CONCLUSION

For the foregoing reasons, the Board's decision that claims 1-8 are unpatentable as obvious should be affirmed. The Board's decision that Sirona's

substitute claims 11-18 are unpatentable as obvious should also be affirmed. In light of the facts properly determined by the Board in consideration of Sirona's substitute claims, the Board's decision that claims 9-10 are not obvious should at least be vacated and remanded.

Dated: May 1, 2017

Respectfully submitted,

/s/Wesley O. Mueller
David M. Airan
Thomas P. Canty
Aaron R. Feigelson
Wesley O. Mueller
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza, Suite 4900
Chicago, Illinois 60601
Telephone: (312) 616-5600
Facsimile: (312) 616-5700
dairan@leydig.com
tcanty@leydig.com
afeigelson@leydig.com
wmueller@leydig.com

Counsel for Cross-Appellants Institut Straumann AG and Dental Wings, Inc.

CERTIFICATE OF FILING AND SERVICE

I hereby certify that on May 1, 2017, a true and correct copy of the foregoing **BRIEF OF CROSS-APPELLANTS** was electronically filed and served through the Court's CM/ECF system to all counsel registered as CM/ECF users, including the principal counsel for the other parties:

Justin J. Oliver
FITZPATRICK, CELLA, HARPER & SCINTO
1290 Avenue of the Americas
New York, New York 10104
Telephone: (212) 218-2100
Facsimile: (212) 218-2200
joliver@fchs.com
Principal Counsel for Appellant
Sirona Dental Systems GmbH

Paper copies will also be mailed to the above principal counsel at the time paper copies are sent to the Court.

Upon acceptance by the Court of the electronically-filed document, six paper copies will be filed with the Court within the time provided in the Court's rules or the time otherwise required by the Court, whichever is earlier.

/s/Aaron R. Feigelson
Aaron R. Feigelson

CERTIFICATE OF COMPLIANCE

This brief complies with the type-volume limitation of Fed. Cir. R. 28.1(b)(2)(A). This brief contains 14,878 words, excluding the parts of the brief exempted by Fed. R. App. P. 32(f) and Fed. Cir. R. 32(b).

This brief complies with the typeface requirements of Fed. R. App. P. 32(a)(5) and the type style requirements of Fed. R. App. P. 32(a)(6), as it has been prepared in a proportionally-spaced typeface using Microsoft Word in 14-point Times New Roman font.

/s/Aaron R. Feigelson
Aaron R. Feigelson